



Proposed Virtual Center of Excellence for Metal Hydride Development

Sandia National Laboratories

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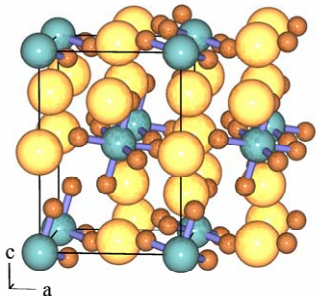
jcwang@sandia.gov

K. Gross, D. Hardesty, J. Keller, B. Replogle, and K. Wilson
Livermore, California

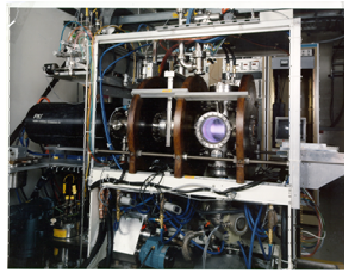
Contact web site: http://www.ca.sandia.gov/metal_hydrides

Sandia: 40 years of Hydrogen Science and Engineering

Fundamental Materials Science



Materials Research and Development



Materials Science and Engineering:
Locomotive, Hydrogen Fuel Cells, Other

Combustion Research Facility
Energy and Environment R&D

High Pressure Laboratory:
Rated for up to 100,000 PSI hydrogen

Environmental Testing:
Shock, Vibration, Thermal

Micro and Nano Technologies Laboratory
EUVL, LIGA, Materials Science



Hydrogen: the renewable
energy carrier
for the 21st Century



Information Center for
Metal-Hydrogen Systems,
Properties, Applications, and Activities

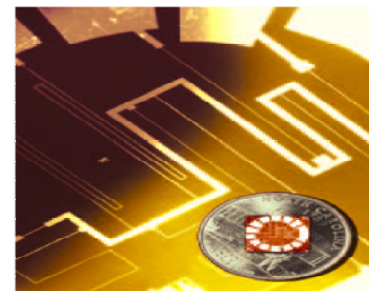
<http://hydpark.ca.sandia.gov/>

We maintain the DOE / IEA
Hydride Database

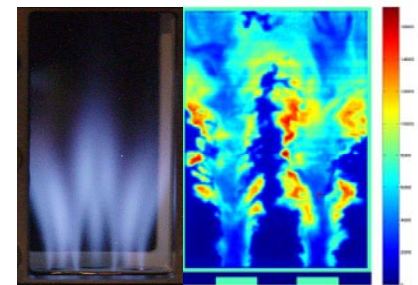
Engineering Science



Hydrogen Microsensors



Combustion

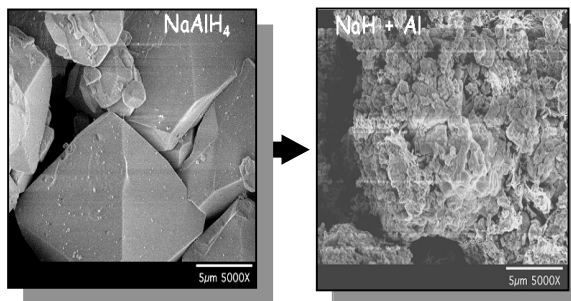
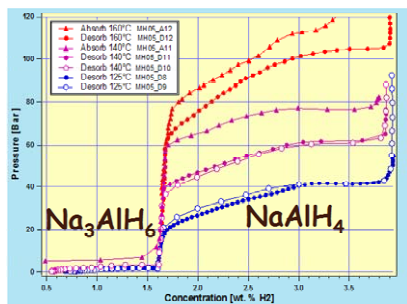


Materials & Engineering
Sciences Center

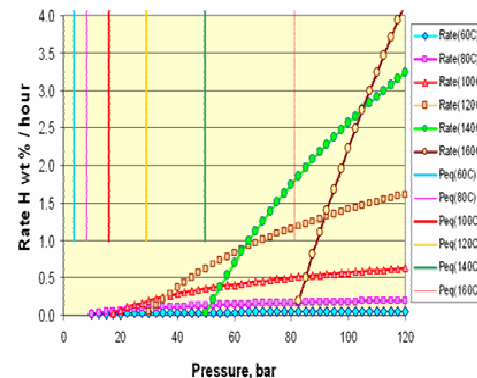
Atoms to Continuum

Storage development within the DOE hydrogen program for 10 years

Materials Research & Development

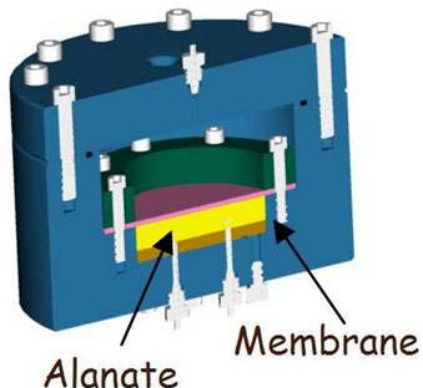


Fundamental Modeling



Initiated alanate development in DOE program In 1997 with Univ. of Hawaii

Engineering Science



Storage System Design & Fabrication

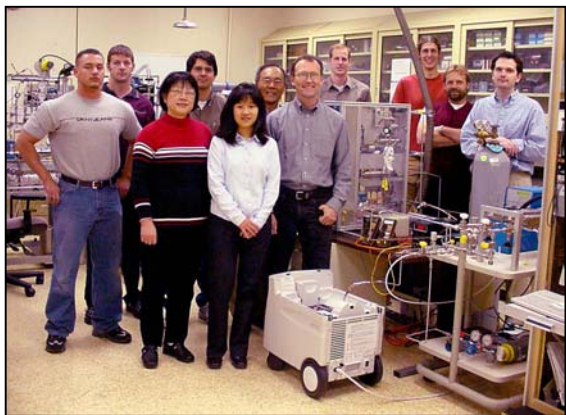


Fuel Cell & Storage System Integration



Hydrogen Storage R&D Capabilities

People



Current Collaborations

- Univ. of Hawaii
- Alanate Working group (UTRC, UH, SRTC, FSEC)
- Univ. of Geneva
- Univ. of Alaska, Fairbanks
- IEA Task 17 members
- USCAR, etc.....

Facilities

- Automated PCT apparatus
- Kinetics (3) & Cycle-life instruments (2)
- In situ X-ray diffraction, SEM, TEM, NMR, XPS, Raman, FTIR, Auger, XRD, XRF, ICP-MS....
- High pressure hydrogen facility 100 ksi
- Test facility: thermal, vibration, & shock

Accomplishments

- Alanates Direct Synthesis method
- Non-reactive dopants
- Fundamental kinetics analysis
- Crystal structure analysis doped alanates
- Measurements and modeling of engineering properties





Future Hydrogen Storage Materials Research

Complex Hydrides

- Complex Hydrides with high capacities
(e.g. $\text{Mg}(\text{AlH}_4)_2$, AlH_6 complexes, Li-alanates, borohydrides....)
- Complex hydride synthesis
(direct synthesis, chemical synthesis, others)
- Na-Alanates
(mechanism of Ti-enhancement, improved doping processes, structural modifications for higher capacities....)
- Engineering sciences for complex hydrides
(engineering properties, safety, contaminations....)

***Other Hydrogen Storage Concepts
are being considered***

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- **Sandia has the desire, expertise, personnel, facilities, and proven record to successfully lead the DOE Metal Hydrides virtual Center of Excellence (MHvCE).**

Our approach will be:

- To focus on achieving or exceeding the DOE's hydrogen storage targets through novel materials development supported by our strengths in fundamental and applied material sciences.
 - To coordinate, support, stimulate, and focus complementary expertise in ***chemistry, material sciences, modeling, synthesis and characterization*** with other national laboratories, universities and industries to achieve the DOE's hydrogen storage goals.
- **Sandia proposes to work with partners from other national labs, universities, and industrial companies to form a backbone team as the MHvCE under the guidance of DOE Hydrogen office.**

If you are interested in teaming with Sandia, we are seeking partners that will add unique capabilities to join our proposed MHvCE.

Please contact us as soon as possible at:

http://www.ca.sandia.gov/metal_hydrides